Polling Question

What is your primary role?

1. HVAC/Mechanical Contractor
2. Consulting/specifying Engineer
3. Building Owner
4. Architect
5. Energy Engineer
6. Facility Manager
7. MEP Engineer
8. Property Manager
9. OEM
10. Other
Upcoming Changes To Commercial Rooftops and Splits

Webinar | October 31st 2017
Meet Your Emerson Moderators

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Factors Influencing The U.S. Commercial A/C Market
Megatrends Driving Change In Commercial Air Conditioning

**Trend**

- Building Automation / Connectivity
- Comfort and Air Quality
- Energy Efficiency and Sustainability

**Emerson Response**

- Sub-system controls / monitoring
- Air Management
  - Latent vs. Sensible
  - IAQ
- Modulation Technologies
  - Compression and controls
- Low-GWP Refrigerants
  - A2L compression
  - Next Gen compression
Polling Question

Are you aware of the change in DOE minimum efficiency requirements for light commercial packaged equipment that will be effective as of 1/1/2018?

1. No, I am not aware
2. Yes, I am aware of the change in efficiency standards
3. Yes, I think this is an opportunity to help me increase sales
4. Yes, I think the new standards pose some business risk
Are you aware of the Department of Energy (DOE) minimum efficiency requirements for light commercial packaged equipment that are effective as of 1/1/2018?

- Yes, I am aware of the efficiency standards: 52%
- No, I am not aware: 10%
- Yes, I think this is an opportunity to help me increase sales: 27%
- Yes, I think the new standard poses some business risk: 11%
DOE Efficiency Regulations For Commercial Equipment (Rooftops & Split Systems Greater Than 6 Tons)

- **ASHRAE 90.1:2016** was adopted for rooftops/splits in two phases.
- National standard for IEER minimums increased in both 2018 and 2023.
- OEMs cannot produce equipment below minimums on 1/1/18.

Note: Below 6 Ton, managed by SEER
Note: Electric Heat values shown other equipment subtract 0.2 IEER
OEM Commercial Portfolio’s Will Refresh To Comply With Regulation

Note: Below 6 Ton, managed by SEER
Note: Electric Heat values shown other equipment subtract 0.2 IEER
Polling Question

Which of the following best describes the impact new efficiency regulations has on your business?

1. Not at all
2. I am concerned about my ability to compete and remain in business
3. Using this opportunity to upsell with higher revenues/margins
4. Other
How Does Compressor Selection Influence IEER?
**How Is System IEER Calculated?**

IEER is a Weighted Average

<table>
<thead>
<tr>
<th>Point</th>
<th>System Net Capacity</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100%</td>
<td>0.020</td>
</tr>
<tr>
<td>B</td>
<td>75%</td>
<td>0.617</td>
</tr>
<tr>
<td>C</td>
<td>50%</td>
<td>0.238</td>
</tr>
<tr>
<td>D</td>
<td>25%</td>
<td>0.125</td>
</tr>
</tbody>
</table>

IEER = (0.020 \cdot A) + (0.617 \cdot B) + (0.238 \cdot C) + (0.125 \cdot D)

What If I can’t run DIRECT at all of those points?

Calculation is adjusted using INTERPOLATION & DEGRADATION
Consider How A System With A Single Mechanical Cooling Stage Might Rate

Outdoor Temperature

Total Compressor Capacity

Capacity/Load (BTU/Hr)

DEGRADE

DIRECT

A Point

B Point

C Point

D Point

Load

2017 1031 Upcoming Changes To Commercial Rooftops and Splits
Consider How A System With Two Mechanical Cooling Stages Might Rate

- **A Point**
- **B Point**
- **C Point**
- **D Point**

**Graph Details**
- **Total Compressor Capacity**
- **Individual Compressor Capacity**
- **Load**
- **Outdoor Temperature**

**Terms**
- **DIRECT**
- **INTERPOLATE**
- **DEGRADE**

2017 1031 Upcoming Changes To Commercial Rooftops and Splits
Copeland Scroll Two-stage Targets Full Load And Highest Weighting Point

- High-Stage Compressor Capacity
- Low-Stage Compressor Capacity
- Load
- Outdoor Temperature

- Capacity/Load (BTU/Hr)

A Point, B Point, C Point, D Point

DEGRADE

DIRECT

2017 1031 Upcoming Changes To Commercial Rooftops and Splits
### Example of How Calculation Plays Out In a System

<table>
<thead>
<tr>
<th>Description</th>
<th>Fixed Single Circuit System</th>
<th>Two-Stage Single Circuit System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressor</td>
<td>ZP83</td>
<td>ZPS83</td>
</tr>
<tr>
<td>Number Of Unique Mechanical Cooling Stages</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Fan Speeds</td>
<td>Fixed</td>
<td>Fixed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Point</th>
<th>Weight</th>
<th>Method</th>
<th>Perf.</th>
<th>Method</th>
<th>Perf.</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>2%</td>
<td>Direct</td>
<td>10.9</td>
<td>Direct</td>
<td>10.9</td>
</tr>
<tr>
<td>75%</td>
<td>62%</td>
<td>Degrade</td>
<td>12.1</td>
<td>Direct</td>
<td>13.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Down From 12.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50%</td>
<td>24%</td>
<td>Degrade</td>
<td>13.0</td>
<td>Degrade</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Down From 15.2)</td>
<td>(Down From 16.9)</td>
<td></td>
</tr>
<tr>
<td>25%</td>
<td>12%</td>
<td>Degrade</td>
<td>11.4</td>
<td>Degrade</td>
<td>12.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Down From 15.9)</td>
<td>(Down From 17.7)</td>
<td></td>
</tr>
</tbody>
</table>

**Fixed IEER = 12.2**  **Two-Stage IEER = 13.9**  **+ 14%**
Two Stage Compressor Delivers Increased Efficiency

- Expanding two-stage technology up to 10HP
- Available Now in advance of 1/1/2018 regulation
- Attractive applied cost and key enabler for 2023 DOE regulation
Two-Stage Technology Overview
Copeland Scroll Two-stage Operation

High-Stage

Vent Holes Closed
Utilizing Full Scroll For Compression

Low-Stage

Vent Holes Open
Bypassing Outer Portion Of Scroll
Copeland Two-stage Scroll Compression Process

High-Stage Capacity

Suction  →  Discharge

Low-Stage Capacity

Suction  →  Discharge
Emerson Solution Portfolio
How familiar are you with the following types of modulation technology?

Variable speed scroll compressors:
- Not familiar at all: 5%
- Slightly familiar: 17%
- Moderately familiar: 31%
- Very familiar: 30%
- Extremely familiar: 18%

Two-stage compressors:
- Not familiar at all: 2%
- Slightly familiar: 11%
- Moderately familiar: 23%
- Very familiar: 39%
- Extremely familiar: 25%
## Compressor Portfolio Overview

*Emerson Has A Wide Offering Of Voltages, Optimization Points & Modulation Options*

<table>
<thead>
<tr>
<th>Fixed</th>
<th>Compressor Horsepower at ARI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZPK5, K6, KC</td>
<td>![Compressor Image]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Modulated</th>
<th>Compressor Horsepower at ARI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZPD (Digital)</td>
<td>![Compressor Image]</td>
</tr>
<tr>
<td>ZPV (VS - BPM)</td>
<td>![Compressor Image]</td>
</tr>
<tr>
<td>ZPKC (VS– Ind)</td>
<td>![Compressor Image]</td>
</tr>
<tr>
<td>ZPS (Two-Stage)</td>
<td>![Compressor Image]</td>
</tr>
<tr>
<td>ZPT, ZPU (Multiples)</td>
<td>![Compressor Image]</td>
</tr>
</tbody>
</table>

*NEW*
# Compressor Modulation Technology Comparison

<table>
<thead>
<tr>
<th>Modulation Technology</th>
<th>Products</th>
<th>Range</th>
<th>Capacity Control</th>
<th>Part Load Efficiency</th>
<th>Full Load Efficiency</th>
<th>Complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZP (Fixed)</td>
<td>2-40HP</td>
<td>ON/OFF</td>
<td>Medium</td>
<td>High</td>
<td>Best</td>
<td></td>
</tr>
<tr>
<td>ZPS (Two-Stage)</td>
<td>2-10HP</td>
<td>67%, 100%</td>
<td>High</td>
<td>High</td>
<td>Best</td>
<td></td>
</tr>
<tr>
<td>ZPD (Digital)</td>
<td>3-15HP</td>
<td>10-100%</td>
<td>Medium</td>
<td>High</td>
<td>Better</td>
<td></td>
</tr>
<tr>
<td>ZPV (Variable Speed)</td>
<td>2-15HP</td>
<td>20-130%</td>
<td>Highest</td>
<td>Medium</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>ZPT, ZPU (Multiples)</td>
<td>3-120HP</td>
<td>30-100%</td>
<td>High</td>
<td>High</td>
<td>Better</td>
<td></td>
</tr>
</tbody>
</table>
Trick Or Treat?
Summary of Upcoming Changes To Commercial Rooftops & Splits

• New efficiency regulations go into effect for commercial rooftops and splits as of January 1st 2018

• Commercial equipment is rated in IEER

• Emerson provides solutions for IEER, Modulation, Complexity
  - Emerson takes a balanced approach to deliver capacity modulation, efficiency and product complexity options to meet OEM design goals
  - New product introductions facilitate OEM designs. Keep your eyes peeled as new products begin to appear in the run up to the 2018 regulation implementation

Happy Halloween!
Thank You For Attending!

To Learn More On “Getting Comfortable With Designer Air”, Please Visit Our Webpage At:


Stay Tuned For More Emails Containing Information And Timing On Our Next Webinar!